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14. ABSTRACT
Improving satellite retrievals of inherent optical properties (lOPs) is increasingly focused on coastal waters because of adjacent population concentrations and susceptibility to anthropogenic impacts. However, their complexity has presented more retrieval challenges than open ocean waters. To address these concerns, and support multi snd hyper-spectral caU,'al, and development of new retrieval techniques and algorithms for coastal waters, we have established a new scientifically comprehensive offshore platform, the Long Island Sound Coastal Observatory (LISCO). Its measurement suite combines multi-(SeaPRISM) and hyperspectral HyperSAS measurements for calibration/validations of current and future Ocean Color satellite as well as for hyperspectral sensors. Recent results from LISCO, which combine multi- and hyperspectral radiometer data radiometers are presented and compared with MODIS satellite data.

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Observation Platform in Long Island Sound for Calibration/validation of Multi-and Hyperspectral Ocean Color Satellite Sensing of Coastal Waters

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Abstract – Improving satellite retrievals of inherent optical properties (IOPs) is increasingly focused on coastal waters because of adjacent population concentrations and susceptibility to anthropogenic impacts. However, their complexity has presented more retrieval challenges than open ocean waters. To address these concerns, and support multi snd hyper-spectral cal/val, and development of new retrieval techniques and algorithms for coastal waters, we have established a new scientifically comprehensive offshore platform, the Long Island Sound Coastal Observatory (LISCO). Its measurement suite combines multi-(SeaPRISM) and hyperspectral HyperSAS measurements for calibration/validations of current and future Ocean Color satellite as well as for hyperspectral sensors. Recent results from LISCO, which combine multi- and hyperspectral radiometer data radiometers are presented and compared with MODIS satellite data.

Key words: coastal water, platform, validation.

1. INTRODUCTION

Advances in oceanic bio-optical processes are expected to be more heavily focused on improving satellite retrieval products of inherent optical properties (IOP) of coastal waters, which, because of their complexity, offer more challenges than open ocean waters, where satellite observations and retrieval algorithms are already reasonably effective. Thus, the validation of the current and future Ocean Color satellite data is important for characterizing the optical environment connected with coastal waters, which are of importance because of population concentrations along them and their susceptibility to anthropogenic impacts. To address these concerns, and support present and future multi- and hyper-spectral calibration/validation activities, as well as the development of new measurement and retrieval techniques and algorithms for coastal waters, City College (CCNY) along with Naval Research Laboratory at Stennis Space Center, has established a new, scientifically comprehensive, off-shore platform, the Long Island Sound Coastal Observatory (LISCO), to serve as a venue and framework for combining multi- and hyperspectral radiometer emasurements with satellite and in-situ measurements and radiative transfer simulations of coastal waters, helping to and provide more effective closure for the whole measurement validation/simulation loop. Measurements from the platform are utilized for multi-spectral calibration/validation of current Ocean Color satellites (MODIS, MERIS, SeaWIFS) in coastal waters, and for evaluating future satellites missions (OCM2, Sentinel 2, NPOESS) with extension to cal/val of hyperspectral sensors (Hyperspectral Imager for Coastal Ocean, HICO), as well as for improvements in coastal IOP retrieval and atmospheric correction algorithms.

The platform combines an AERONET SeaPRISM radiometer (CIMEL ELECTRONIQUE, France) as a part of AERONET Ocean Color Network (Zibordi *et al.*, 2009), with a co-located HyperSAS (Satlantic, Canada) set of radiometers capable of hyperspectral measurements of water leaving radiance, sky radiance and down welling irradiance. Both instruments were installed on the Long Island Sound Coastal Observatory (LISCO) in October 2009 and since then have been providing data. SeaPRISM data are transferred by the satellite link to NASA, processed by the NASA AERONET group and posted on the NASA AERONET website. HyperSAS data are transmitted by broadband cellular service to the CCNY server. The LISCO site is located ~2 miles from the shore on the oil offloading platform which belongs to the power generation company, National Grid. The coordinates of the site are N 40°57'16", W73°20'30" with an elevation of 12m. The instruments are positioned on a retractable tower on the platform. This is shown below in Fig. 1.

Figure 1. Retractable tower with SeaPRISM and HyperSAS instruments on the LISCO platform.

2. WATER PARAMETERS IN THE AREA NEAR THE PLATFORM

Analysis of area water characteristics were done from MODIS – Aqua satellite data, processed using SeaDAS software v. 5.0.3 with the standard atmospheric correction. Average chlorophyll concentration [Chl] values in the pixels in the immediate vicinity of the platform were found to be: 3-8 mg/l. Backscattering coefficients are in the range 0.01-0.02 m^{-1} , which assuming a backscattering ratio of 1% corresponds to about 1-2 mg/l of Total Suspended Solids. Non algal absorption, mostly due to CDOM for these TSS values, ranges from 0.1 to 0.3m^{-1}, where, according to NOAA HF Radar data, surface currents in the area are 0.2-0.4 m/s. These values are typical of moderate coastal waters. Time series of water parameters in the platform vicinity

show these to be typical for coastal water conditions, and the moderate variability observed, Fig 2, can be expected to help establish robust relationships between reflectance values and water parameters, facilitating application to satellite retrieval algorithms.

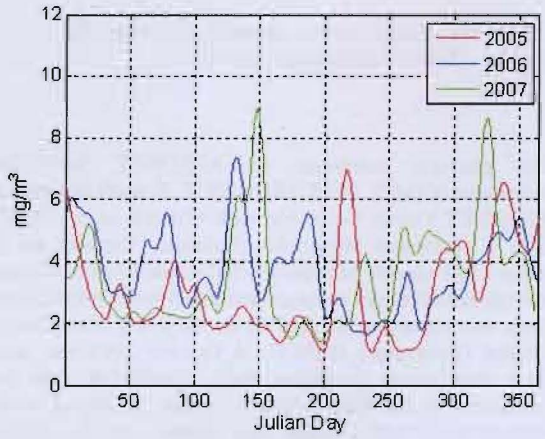

Figure 2. Chlorophyll Concentration (2005 – 2010)

The observed values and variability of parameters will also allow validation over a reasonable range of radiances. Additional study of MODIS satellite imagery also typically showed small spatial variability of parameters in the pixels near the platform, Fig 3. This permits SeaPRISM and HyperSAS measurements to be compared with satellite data averaged over neighboring (300-1000m) pixels.

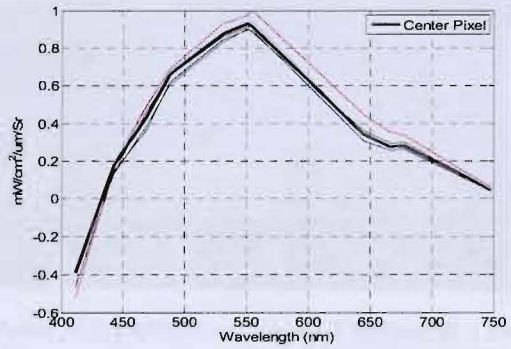

Figure 3. MODIS Normalized Water Leaving Radiances of platform and adjacent pixels (Jan 18 2010 18:15 UTC)

3. COMPARING SEAPRISM, HYPERSAS, MODIS

Fig 4, shows an excellent match for total water leaving radiances as measured by SeaPRISM, at specific discrete wavelengths, and HyperSAS, continuosly over the same wavelength range. Fig 5 shows a match for normalized water leaving radiances as obtained from MODIS and SeaPRISM, standard MODIS and Aeronet Protocols. The results shown use the NIR atmospheric correction. Furthermore, given the excellent match between the water leaving radiances of SeaPRISM and HyperSAS shown above in Fig 4, the expected HyperSAS response is also added in Fig 5 by fitting it to the SeaPRISM response at the latter's wavelengths. Direct independent derivation of HyperSAS response for the same scene is being investigated using its own atmospheric transmission measurements to independently validate SeaPRISM response and match-up with MODIS.

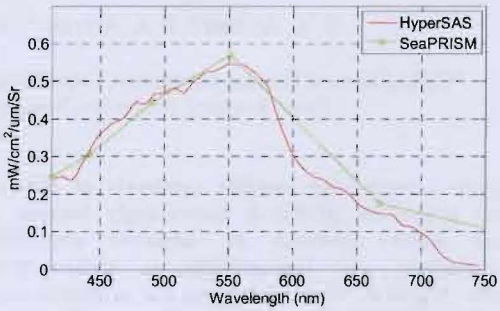

Figure 4. Comparison of total radiances (Jan 18 2010)

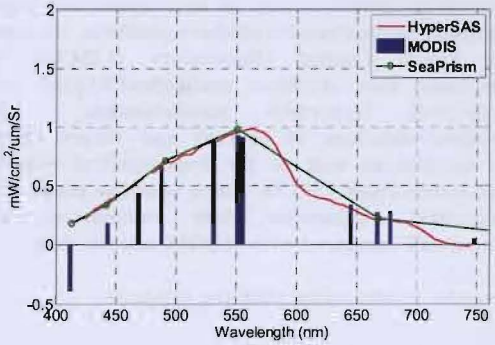

Figure 5. Comparison of Normalized Water Leaving Radiances (MODIS and LISCO Data)

4. CONCLUSION

It is expected that with the further development of measurement, processing and match up procedures currently underway, LISCO will fully prove its utility for calibration/validation of current Ocean Color satellites, for evaluating future satellites missions and hyperspectral sensors (HICO), as well as for improvements in coastal IOP retrievals and atmospheric correction algorithms.

ACKNOWLEDGEMENT

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